

CLAIMS

1 1. A method of converting a non-gaseous sample for accelerator mass spectrometry
2 analysis, comprising:

3 converting desired elements present in the non-gaseous sample to a predetermined
4 gaseous form; and

5 transporting the predetermined gaseous form to an accelerator mass spectrometer ion
6 source.

1 2. The method of claim 1, wherein said step of converting comprises chemically reacting
2 the non-gaseous sample.

1 3. The method of claim 2, wherein said step of chemically reacting comprises oxidizing
2 the non-gaseous sample.

1 4. The method of claim 3, wherein said step of oxidizing comprises converting carbon in
2 the sample to carbon dioxide.

1 5. The method of claim 2, wherein said step of chemically reacting comprises pyrolyzing
2 the non-gaseous sample.

1 6. The method of claim 5, wherein said step of pyrolyzing comprises converting hydrogen
2 in the sample to molecular hydrogen.

1 7. The method of claim 1, wherein prior to said step of converting, said method
2 comprises:

3 depositing the non-gaseous sample on a solid substrate, and

4 desorbing the non-gaseous sample from said substrate.

1 8. The method of claim 7, wherein said step of desorbing comprises irradiating the sample
2 with a laser beam.

1 9. The method of claim 7, wherein volatile components are removed from the sample
2 subsequent to said step of depositing and prior to said step of desorbing.

1 10. The method of claim 1, wherein prior to said step of converting, said method comprises
2 nebulizing the sample.

1 11. The method of claim 10, wherein said step of nebulizing comprises thermospraying the
2 sample.

1 12. The method of claim 10, wherein said step of nebulizing comprises electrospraying the
2 sample.

1 13. The method of claim 10, wherein said step of nebulizing comprises substantially
2 removing volatile components from the sample.

1 14. A method of converting a non-gaseous sample for analytical processing, said method
2 comprising:

3 nebulizing the sample using electrospray;

4 converting desired elements present in the nebulized sample to a predetermined gaseous
5 form; and

6 providing the predetermined gaseous form to an analytical processing device for
7 analysis.

1 15. The method of claim 14, wherein the analytical processing device comprises an isotope
2 ratio mass spectrometer.

1 16. The method of claim 14, wherein the analytical processing device comprises an
2 accelerator mass spectrometer.

1 17. The method of claim 14, wherein said step of converting comprises directing at least a
2 portion of the nebulized sample into a chemical reactor.

1 18. The method of claim 14, wherein prior to said step of nebulizing, said method
2 comprises adding sub-micrometer sized particles to the non-gaseous sample.

1 19. The method of claim 18, wherein said sub-micrometer sized particles comprise silicon
2 dioxide.

1 20. The method of claim 18, wherein said sub-micrometer sized particles comprise barium
2 hexaaluminate.

1 21. A method of converting a non-gaseous sample for analytical processing, comprising:
2 injecting the sample directly into a converter;
3 converting desired elements present in the sample to a predetermined gaseous form; and
4 providing the predetermined gaseous form to an analytical device for processing.

1 22. The method of claim 21, wherein the analytical processing device comprises an

2 accelerator mass spectrometer.

1 23. The method of claim 21, wherein the analytical processing device comprises an isotope
2 ratio mass spectrometer.

1 24. The method of claim 21, wherein said step of converting comprises converting the
2 hydrogen in the sample to molecular hydrogen.

1 25. The method of claim 21, wherein said converter comprises a pyrolyzer.

1 26. The method of claim 21, wherein said step of injecting comprises introducing the
2 sample into the converter using a piezo-electric pipetter.

1 27. An interface for introducing a non-gaseous sample as a predetermined gaseous form into
2 an accelerator mass spectrometer, said interface comprising:

3 a nebulizer that receives the non-gaseous sample to provide a fine spray of the sample;

4 a converter that receives at least a portion of said fine spray and converts the desired
5 elements to the predetermined gaseous form; and

6 a flow line that transports the predetermined gaseous form to the accelerator mass
7 spectrometer.

1 28. The interface of claim 27, wherein said nebulizer comprises an electrospray nebulizer.

1 29. The interface of claim 27, wherein said nebulizer comprises a thermospray nebulizer

1 30. The interface of claim 27, further comprising a chamber that couples said nebulizer to
2 said converter, said chamber comprising means for reducing the flow of matter that does not
3 contain analyte into said converter.

1 31. The interface of claim 30, wherein said chamber comprises a momentum separator.

1 32. The interface of claim 30 wherein said chamber comprises means for producing a beam
2 of particles preferentially composed of analyte.

1 33. A sample processing interface for introducing a non-gaseous sample as a predetermined
2 gaseous form into an analytical instrument, said interface comprising:

3 an electrospray nebulizer that receives the non-gaseous sample to provide a fine spray of
4 the sample;

5 a converter that receives at least a portion of said fine spray and converts the desired
6 elements in the spray to the predetermined gaseous form; and

7 a flow line that transports the predetermined gaseous form to the analytical instrument.

1 34. The interface of claim 33 wherein the analytical instrument comprises an accelerator
2 mass spectrometer.

1 35. The interface of claim 33 wherein said converter comprises copper oxide.

1 36. A device for introducing a non-gaseous sample as a predetermined gaseous form into an
2 analytical instrument, said device comprising:

3 an injector that receives the non-gaseous sample and provides a directed stream of the
4 non-gaseous sample;

5 a converter that receives at least a portion of said directed stream and converts the desired
6 elements to the predetermined gaseous form; and

7 a flow line that transports the predetermined gaseous form to the analytical instrument.

1 37. The device of claim 36, wherein said injector is configured and arranged to provide a
2 drop diameter less than about 500 μm and a sufficiently high drop velocity to permit droplets to
3 travel a distance greater than about 1 cm in air.

1 38. The device of claim 37 wherein said injector comprises a piezoelectric pipetter.

1 39. The device of claim 36 wherein said converter comprises elemental carbon.

1 40. An interface for introducing a non-gaseous sample as a predetermined gaseous form into
2 an accelerator mass spectrometer, said interface comprising:

3 a first stage that receives the non-gaseous sample and separates analyte from carrier
4 material of the sample, to provide a separated sample stream that preferentially comprises the
5 analyte; and

6 a second stage that receives said separated sample stream, converts the desired elements
7 in said sample stream to the predetermined gaseous form, and transports the predetermined
8 gaseous form along a flow line to the accelerator mass spectrometer.

1 41. The interface of claim 40, wherein said first stage comprises a nebulizer.

1 42. The interface of claim 40, wherein said first stage comprises means for desorption.

1 43. The interface of claim 42 wherein said means for desorption comprises a laser.

1 44. The interface of claim 40 wherein said second stage comprises an oxidizing reactor.